CLAIMS

We Claim:

1. A composition for photokinetic delivery of a biologically active substance using pulsed incoherent light, comprising a biologically active substance, a solvent, a gelling agent and a photocatalytic agent, wherein said photocatalytic agent has a band gap energy of between about 2.9 eV and about 3.2 eV.

2. The composition according to claim 1 wherein said photocatalytic agent is present in said composition at a concentration of between 0.001% and 20% (w/w).

3. The composition according to claim 2 wherein said photocatalytic agent is present in said composition at a concentration of 2% (w/w).

4. The composition according to claim 1 wherein said biologically active substance is present in said composition at a concentration of between about 0.01% and about 2% (w/v).

5. The composition according to claim 1 wherein said gelling agent is present in said composition at a concentration of between 0.1% and 10% (w/v).

6. The composition according to claim 1 wherein said biologically active substance is selected from the group consisting of chemicals, drugs,

antibiotics, peptides, hormones, proteins, DNA, RNA and mixtures thereof.

7. The composition according to claim 6 wherein said chemical is a polar or non-polar compound.

8. The composition according to claim 7 wherein said polar compound is selected from the group consisting of theophylline-7 acetic acid, sodium ascorbyl phosphate, ascorbic acid, ascorbyl palmitate, pyridoxine and nicotinic acid.

9. The composition according to claim 8 wherein said polar compound is pyridoxine.

10. The composition according to claim 7 wherein said non-polar compound is selected from the group consisting of theobromine, theophylline, caffeine and nicotinamide.

11. The composition according to claim 6 wherein said drug is selected from the group consisting of analgesics, anaesthetics, antacids, antianxiety drugs, antiarrhythmics, antibacterials, antibiotics, anticoagulants and thrombolytics, anticonvulsants, antidepressants, antidiarrheals, antiemetics, antifungals, antihistamines, antihypertensives, anti-inflammatories, antieoplastics, antipsychotics, antipyretics, antivirals, barbiturates, beta-blockers, bronchodilators, cold cures, corticosteroids, cough suppressants, cytotoxics, decongestants, diuretics, expectorants, hormones, hypoglycemics, immunosuppressives, laxatives, muscle relaxants, sedatives, sex hormones, sleeping drugs, tranquilizers and vitamins.

12. The composition according to claim 11 wherein said anaesthetic is lidocaine.

13. The composition according to claim 6 wherein said peptide is selected from the group consisting of Gly-Tyr, Val-Tyr-Val, Tyr-Gly-Gly-Phe-Met, Tyr-Gly-Gly-Phe-Leu and Asp-Arg-Val-Tyr-Ile-His-Pro-Phe.

14. The composition according to claim 6 wherein said hormone is selected from the group consisting of methionine enkephalin acetate, leucine enkephalin, angiotensin II acetate, β-estradiol, methyl testosterone, progesterone and insulin.

15. The composition according to claim 6 wherein said protein is selected from the group consisting of enzymes, non-enzymes, antibodies and glycoproteins.

16. The composition according to claim 6 wherein said antibiotic is amphotericin B.

17. The composition according to claim 1 wherein said gelling agent is selected from the group consisting of hydroxyethyl cellulose, Natrasol®, pectines, agar, alginic acid and its salts, guar gum, pectin, polyvinyl alcohol, polyethylene oxide, cellulose and its derivatives, propylene carbonate, polyethylene glycol, hexylene glycol sodium carboxymethylcellulose, polyacrylates, polyoxyethylene-polyoxypropylene block copolymers, pluronics, wood wax alcohols and tyloxapol.

18. The composition according to claim 17 wherein said gelling agent is hydroxypropyl cellulose.

19. The composition according to claim 1 wherein said photocatalytic agent is a rutile form of titanium dioxide.

20. The composition according to claim 1 wherein said photocatalytic agent is selected from the group consisting of an anatase form of titanium dioxide, brookite form of titanium dioxide, ZnO, ZrO_2 and Sc_2O_3.

21. The composition according to claim 1 wherein said solvent is an aqueous or an organic solvent.

22. The composition according to claim 21 wherein said aqueous solvent is water.

23. The composition according to claim 21 wherein said aqueous solvent is an aqueous solution of ethyl lactate or propylene glycol.

24. A method of photokinetic delivery comprising:

preparing a solution comprising a biologically active substance and a solvent;

applying said solution to a cellular surface;

illuminating said solution on said cellular surface with a pulsed incoherent light having a selected wavelength, pulse rate and duty cycle; and

allowing said solution to permeate said cellular surface.

25. The method according to claim 24 wherein said solution further comprises a gelling agent.

26. The method according to claim 24 wherein said solution further comprises a photocatalytic agent.

27. The method according to claim 24 wherein said biologically active substance is selected from the group consisting of chemicals, drugs, antibiotics, peptides, hormones, proteins, DNA, RNA and mixtures thereof.

28. The method according to claim 27 wherein said chemicals comprise a polar or a non-polar compound.

29. The method according to claim 28 wherein said polar compound is selected from the group consisting of theophylline-7 acetic acid, sodium ascorbyl phosphate, ascorbic acid, ascorbyl palmitate, pyridoxine, nicotinic acid and lidocaine.

30. The method according to claim 28 wherein said non-polar compound is selected from the group consisting of theobromine, theophylline, caffeine and nicotinamide.

31. The method according to claim 27 wherein said drug is selected from the group consisting of analgesics, anaesthetics, antacids, antianxiety drugs, antiarrhythmics, antibacterials, antibiotics, anticoagulants and thrombolytics, anticonvulsants, antidepressants, antidiarrheals, antiemetics, antifungals, antihistamines, antihypertensives, anti-inflammatories, antieoplastics, antipsychotics,

antipyretics, antivirals, barbiturates, beta-blockers, bronchodilators, cold cures, corticosteroids, cough suppressants, cytotoxics, decongestants, diuretics, expectorant, hormones, hypoglycemics, immunosuppressives, laxatives, muscle relaxants, sedatives, sex hormones, sleeping drugs, tranquilizer and vitamins.

32. The method according to claim 27 wherein said peptide is selected from the group consisting of Gly-Tyr, Val-Tyr-Val, Tyr-Gly-Gly-Phe-Met, Tyr-Gly-Gly-Phe-Leu and Asp-Arg-Val-Tyr-Ile-His-Pro-Phe.

33. The method according to claim 27 wherein said hormone is selected from the group consisting of methionine enkephalin acetate, leucine enkephalin, angiotensin II acetate, β-estradiol, methyl testosterone and progesterone.

34. The method according to claim 27 wherein said protein is selected from the group consisting of enzymes, non-enzymes, antibodies and glycoproteins.

35. The method according to claim 24 wherein said gelling agent is selected from the group consisting of hydroxyethyl cellulose, Natrasol®, pectines, agar, alginic acid and its salts, guar gum, pectin, polyvinyl alcohol, polyethylene oxide, cellulose and its derivatives, propylene carbonate, polyethylene glycol, hexylene glycol sodium carboxymethylcellulose, polyacrylates, polyoxyethylene-polyoxypropylene block copolymers, pluronics, wood wax alcohols and tyloxapol.

36. The method according to claim 24 wherein said photocatalytic agent has a band gap energy of between about 2.9 eV and about 3.2 eV.

37. The method according to claim 24 wherein said photocatalytic agent is a rutile form of titanium dioxide.

38. The method according to claim 24 wherein said photocatalytic agent is an anatase form of titanium dioxide.

39. The method according to claim 24 wherein said solvent is an aqueous or an organic solvent.

40. The method according to claim 39 wherein said aqueous solvent is water.

41. The method according to claim 39 wherein said aqueous solvent is an aqueous solution of ethyl lactate or propylene glycol.

42. The method according to claim 24 wherein said cellular surface is an outer layer of a skin of a mammal.

43. The method according to claim 24 wherein said cellular surface is a cell membrane.

44. The method according to claim 24 wherein said pulsed incoherent light is selected from the group consisting of fluorescent, ultraviolet, visible, near infrared and halogen light.

45. The method according to claim 44 wherein said fluorescent light has a wavelength range from about 260 nm to about 760 nm.

46. The method according to claim 44 wherein said ultraviolet light has a wavelength range from about 340 nm to about 900 nm.

47. The method according to claim 44 wherein said visible light has a wavelength range from about 340 nm to about 900 nm.

48. The method according to claim 44 wherein said near infrared light has a wavelength range from about 340 nm to about 900 nm.

49. The method according to claim 44 wherein said halogen light has a wavelength range from about 340 nm to about 900 nm.

50. The method according to claim 24 wherein said wavelength is selected from the group consisting of 350 nm, 390 nm, 405 nm and 450 nm.

51. The method according to claim 24 wherein said pulse rate is between about 1.7 cps and about 120 cps.

52. The method according to claim 51 wherein said pulse rate is between about 1.7 cps and about 80 cps.

53. The method according to claim 24 wherein said duty cycle is between about 50% and about 75%.

54. A device for photokinetic transdermal delivery, said device comprising:

a generator that provides an oscillating electrical pulse;

at least one light emitting diode that receives the oscillating electrical pulse and responds by providing an incoherent light; and

a donor cell that holds a solution comprising a biologically active substance and a solvent; wherein:

the donor cell is positioned to receive the incoherent light.

55. The device according to claim 54 wherein said generator is a repeat cycle square wave pulse generator.

56. The device according to claim 54 further comprising a light pad, wherein at least one light emitting diode is embedded in said light pad.

57. The device according to claim 56 wherein said light pad is comprised of an optically clear material.

58. The device according to claim 57 wherein said optically clear material is poly(methyl-methacrylate) or silicone rubber.

59. The device according to claim 54 wherein said light emitting diode emits a light having a wavelength selected from the group consisting of 350 nm, 390 nm, 405 nm and 450 nm.

60. The device according to claim 54 wherein said solution further comprises a gelling agent.

61. The device according to claim 54 wherein said solution further comprises a photocatalytic agent.